CHALMERS

Protocols with Heterogeneous Real-Time Services for High-Performance Embedded Networks

Carl Bergenhem

Licentiate seminar will be held in Halmstad University,
Theatre M104 (at the library), Kristian IV:s väg, Halmstad
on the 19th December, 2002 at 13:15

The discussions will be conducted by Prof. Christer Norström,
Mälardalen University

The thesis is available at:
The Department of Computer Engineering, Chalmers University of Technology
or The School of Information Science, Computer and Electrical Engineering,
Halmstad University

Department of Computer Engineering
School of Computer Science and Engineering

CHALMERS UNIVERSITY OF TECHNOLOGY
412 96 Göteborg
Tel: 031 − 772 10 00

School of Information Science,
Computer and Electrical Engineering

HALMSTAD UNIVERSITY
301 18 Halmstad
Tel: 035 − 16 71 00

Protocols with Heterogeneous Real-Time Services for High-Performance Embedded Networks

CARL BERGENHEM
School of Information Science, Computer and Electrical Engineering, Halmstad University.
Department of Computer Engineering, Chalmers University of Technology

Thesis for the degree of Licentiate of Engineering

Abstract

Network protocols for applications that demand high performance and heterogeneous real-time services are presented. These protocols control the medium access to the network and offer additional features to the user, both different user services for traffic and services for parallel and distributed real-time processing. The network architecture assumed is a unidirectional pipelined optical ring.

Radar Signal Processing (RSP) is a typical application area. Such a system contains many computation nodes that are interconnected in order to co-operate and thereby achieve higher performance. The computing performance of the whole system is greatly affected by the choice of network. Computing nodes in a parallel computer for RSP should be tightly coupled, i.e., communications cost (e.g. latency) between nodes should be small, so that the whole system can be perceived as a single unit. This is possible if a suitable network with an efficient protocol is used.

There is an industrial need for new high-performance networks with support for the, often heterogeneous, real-time requirements found in (often embedded) applications such as RSP and other areas such as multimedia. The traffic this kind of network can be classified according to its requirements. The proposed protocols partition the traffic into three classes with distinctly different qualities. These classes are traffic with hard real-time demands, such as mission critical commands, traffic with soft real-time demands, such as process data (a deadline miss here only leads to decreased performance) and, finally, traffic with no real-time constraints at all. The contributions of the present thesis are protocols that integrate heterogeneous real-time services for the three traffic classes.

The performance of the proposed protocols is evaluated through simulations and analysis. It is shown that the protocol is an efficient choice for RSP systems. A brief survey of related technologies is included in the thesis. These are studied from the perspectives of application, architecture and user service.

Keywords: Optical, Ring, Pipeline, Distributed, Parallel-Processing, Real-time, SAN (System Area Network), Heterogeneous, Service